**Astrophysics Research And Analysis**

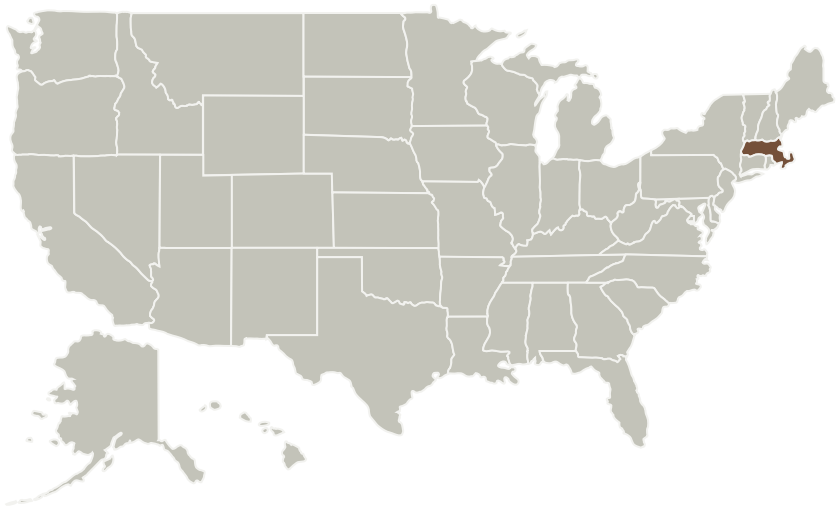
# Compact, scalable deformable mirror systems for space-based imaging of exo-earths

Completed Technology Project (2016 - 2017)

## Project Introduction

In the proposed project, Boston Micromachines Corporation (BMC) plans to demonstrate a new architecture and integration approach for compact, robust large-format deformable mirrors (LFDM) and to show a feasible path for scaling up that demonstration platform and manufacturing integration approach to larger formats with up to 10,000 actuators. These LFDMs will take advantage of BMC's proven and scalable microelectromechanical (MEMS) silicon processing technology while substantially reducing the required size and weight of the driver system and eliminating the need for high-density cables. NASA's Exoplanet Exploration Program (EEP) recently identified LFDMs as a critical technology gap for the high-resolution coronagraph instruments that are at the core of EEP's technology plan. This proposal specifically addresses EEP's request for technology development efforts that redesign the electronic interconnectors to the actuators and miniaturize the drive electronics, thereby making LFDM systems more technologically ready for space missions. In this project, BMC will demonstrate feasibility of low-stress, high-reliability bonding of MEMS arrays to interposers. Also, BMC will demonstrate complete integration of a MEMS system based on the new LDFM design. The integrated system will feature 32×32 actuator MEMS arrays capable of up to 1.5 µm of stroke, 1 kHz frame update rate, and 14 bit precision. It will consume no more than 8 Watts of power, and will be contained within a cubic volume measuring 100 mm on a side. Finally, BMC will develop a technology plan and design for scale-up of the approach to LFDMs with up to 96×96 actuators.

## Primary U.S. Work Locations and Key Partners

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## Organizational Responsibility

**Responsible Mission Directorate:**

Science Mission Directorate (SMD)

**Responsible Program:**

Astrophysics Research and Analysis

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| Boston Micromachines Corporation | Supporting Organization | Industry | Cambridge, Massachusetts |

| Primary U.S. Work Locations |
|---|
| Massachusetts |

## Project Management

**Program Director:**

Michael A Garcia

**Program Manager:**

Dominic J Benford

**Principal Investigator:**

Peter J Ryan

**Co-Investigators:**

Thomas Bifano
Paul A Bierden

## Technology Areas

**Primary:**

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.3 Control Technologies
    - TX17.3.4 Control Force/Torque Actuators

## Target Destination

Outside the Solar System